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| EXAMINER |
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CHUO, TONY SHENG HSIANG

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1795

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10/24/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|-------------------------------|-------------------------------|--|
| Office Action Summary | Application No. 10/668,976 | Applicant(s) MORRIS ET AL. | |
| | Examiner Tony Chuo | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 September 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
 4a) Of the above claim(s) 18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 and 19-26 is/are rejected.
- 7) ☒ Claim(s) 9 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 July 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Claims 1-26 are currently pending. Claim 18 is withdrawn as being drawn to a non-elected invention. New claims 24-26 have been added. The previously stated 112, 1st paragraph rejection of claims 1-17 and 19-23 is withdrawn. The previously stated 112, 2nd paragraph rejection of claims 1-17 and 19-23 is withdrawn. The amended claims do overcome the previously stated 102 and 103 rejections. However, upon further consideration, claims 1-17 and 19-26 are rejected under the following new 103 rejections. This action is made FINAL as necessitated by the amendment.

Claim Objections

2. Claim 9 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 1 already recites a carbon nanotube that has been lithiated. Therefore, claim 9 does not further limit the subject matter of claim 1.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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4. Claims 24 and 25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The subject matter "lithiating agents such as n-butyl lithium, or lithium metal oxides" and "polyether phosphate or an alkyl phosphate" are not supported by the specification.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear what type of electrolyte is a PEP electrolyte.

7. Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear whether both the anode and cathode comprise carbon nanotubes that are lithiated.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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9. Claims 1, 2, 5, 7-9, 11-13, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390).

The Zhou reference discloses a battery comprising an anode "50" in electrical communication with a cathode "48", a separator "52" that separates the anode and cathode, and electrical contacts for electrical communication between the anode and cathode, wherein the anode is a lithium foil and the cathode is a single-walled nanotube film (See column 5, lines 44-53). It also discloses a separator "52" that comprises a lithium salt electrolyte wherein the electrolyte comprises a LiClO_4 and ethylene carbonate and dimethyl carbonate (See column 5, lines 48-51). It also discloses a purified single-walled carbon nanotubes that has a reversible capacity of approximately 650 mAh/g (See column 5, lines 60-65). It also discloses purified single-walled carbon nanotubes that has reversible capacity that can be further increased to 900-1000 mAh/g ($\text{Li}_{2.4}\text{C}_6$) which implies that the single-walled nanotube is charged up to Li_1C_3 (See column 5, lines 65-67).

However, Zhou et al does not expressly teach an anode that is comprised of carbon nanotubes that has been lithiated in advance of battery fabrication; an anode that is prelithiated chemically or electrochemically using suitable lithiating agents such as n-butyl lithium, lithium metal, or lithium metal oxides; or an anode that is comprised of multi-walled nanotubes that are lithiated. The Chen reference discloses a battery comprising an anode that comprises multi-walled carbon nanotubes which is lithiated electrochemically by using lithium metal oxides (See column 2, lines 34-45).

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Examiner's note: The Zhou battery in a charged state comprises a cathode that includes single walled carbon nanotubes. The Chen battery in a charged state comprises an anode that includes lithiated multi-walled carbon nanotubes. In addition, it is inherent that the single-walled carbon nanotubes taught by Zhou et al has a carbon nanotube alkali saturation that is MC_8 , wherein M is selected from the group consisting of K, Rb, and Cs.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Zhou battery to substitute the lithium foil anode with an anode that is comprised of carbon nanotubes that has been lithiated in advance of battery fabrication; an anode that is prelithiated chemically or electrochemically using suitable lithiating agents such as n-butyl lithium, lithium metal, or lithium metal oxides; or an anode that is comprised of multi-walled nanotubes that are lithiated in order to utilize an anode material that has high charge/discharge capacities. In addition, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Chen et al indicates that lithiated multi-walled carbon nanotube is a suitable material for use as an anode for a lithium ion battery. The selection of a known material based on its suitability for its intended use has generally been held to be *prima facie* obvious (MPEP §2144.07). As such, it would be obvious to use lithiated multi-walled carbon nanotube.

Examiner's note: It is noted that claim 24 is being construed as product-by-process and that the product itself does not depend on the process of making it.

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Accordingly, in a product-by-process claim, the patentability of a product does not depend on its method of production.

10. Claims 3, 4, 10, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 and 2 above, and further in view of Raffaele et al ("Carbon Nanotube Anodes for Lithium Ion Batteries", Materials Research Society Symposium Proceedings, Vol. 706, 2002, pg. 10.5.1-10.5.7). In addition, Chen et al also discloses cathode comprising LiNiCoO_2 (See column 2, lines 36-38)

However, Zhou et al as modified by Chen et al does not expressly teach an anode that also comprises single-walled carbon nanotubes that are charged up to Li_1C_3 ; or a cathode comprising LiNiCoO_2 . The Raffaele reference discloses highly purified single-walled carbon nanotubes that are used as an anode material for lithium ion batteries that inherently is charged up to Li_1C_3 (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include an anode that also comprises single-walled carbon nanotubes that are charged up to Li_1C_3 in order to utilize an anode material that has high charge/discharge capacities. In addition, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Raffaele et al indicates that lithiated single-walled carbon nanotubes is a suitable material for use as an anode for a lithium ion battery. The selection of a known material based on its suitability for its intended use has generally been held to be *prima facie* obvious (MPEP §2144.07). As

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such, it would be obvious to use lithiated single-walled carbon nanotube. In addition, it would have been obvious to combine single-walled nanotubes and LiNiCoO_2 , each of which is taught by the prior art to be useful for the same purpose, to form a third composition which is used for the very same purpose (*In re Kerkhoven* 205 USPQ 205 USPQ 1069 (CCPA 1980)).

11. Claims 6, 21, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 and 5 above, and further in view of Chen et al (US 2003/0157413).

However, Zhou et al as modified by Chen et al does not expressly disclose a PEP electrolyte; an electrolyte that comprises a liquid polyether phosphate or polyether phosphonate or an alkyl phosphate or phosphonate; or an electrolyte that is a nonflammable polyether phosphate liquid together with a lithium salt. The Chen '413 reference discloses a solvent for a non-aqueous electrolyte containing a lithium salt and a flame resistant additive such as alkyl phosphate (See Claim 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Ochoa battery to include a PEP electrolyte; an electrolyte that comprises a liquid polyether phosphate or polyether phosphonate or an alkyl phosphate or phosphonate; or an electrolyte that is a nonflammable polyether phosphate liquid together with a lithium salt in order to improve the safety of the battery by including a flame resistant additive in the electrolyte solution.

12. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1

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above, and further in view of Raffaele et al ("Carbon Nanotube Anodes for Lithium Ion Batteries", Materials Research Society Symposium Proceedings, Vol. 706, 2002, pg. 10.5.1-10.5.7) and Ochoa et al (US 2003/0099883).

However, Zhou et al as modified by Chen et al does not expressly teach an anode comprising lithiated single-walled nanotubes. The Raffaele reference discloses highly purified single-walled carbon nanotubes that are used as an anode material for lithium ion batteries (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include an anode that comprises single-walled carbon nanotubes in order to utilize an anode material that has high charge/discharge capacities.

However, Zhou et al as modified by Chen et al and Raffaele et al does not expressly teach a cathode that comprises single-walled nanotubes doped in a lithium metal oxide. The Ochoa reference discloses a cathode that lithiated cobalt oxide that is doped with single-walled carbon nanotubes (See paragraph [0021]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen/Raffaele battery to include a cathode that comprises single-walled nanotubes doped in a lithium metal oxide in order to improve the capacity, thermal stability, and safety of the electrode.

13. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 above, and further in view of Raffaele et al ("Carbon Nanotube Anodes for Lithium Ion Batteries",

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Materials Research Society Symposium Proceedings, Vol. 706, 2002, pg. 10.5.1-10.5.7) and Ogura et al (US 2002/0061441).

However, Zhou et al as modified by Chen et al does not expressly teach an anode comprising lithiated single-walled nanotubes. The Raffaele reference discloses highly purified single-walled carbon nanotubes that are used as an anode material for lithium ion batteries (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include an anode that comprises single-walled carbon nanotubes in order to utilize an anode material that has high charge/discharge capacities.

However, Zhou et al as modified by Chen et al and Raffaele et al does not expressly teach single-walled nanotubes that have been treated with a gas selected from the group consisting of CO₂, CO, NO₂, NO, N₂O, O₂, peroxides, O₃, SO₂, and CH₂CO. The Ogura reference discloses chemical treatments of carbon nanotubes that are used for electrodes in a lithium battery that include oxidation with ozone (See paragraph [0046]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen/Raffaele battery to include single-walled nanotubes that have been treated with a gas selected from the group consisting of CO₂, CO, NO₂, NO, N₂O, O₂, peroxides, O₃, SO₂, and CH₂CO in order to disentangle the aggregates of carbon nanotubes and facilitate the manufacture of a battery electrode.

14. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 above, and further in view of Raffaele et al ("Carbon Nanotube Anodes for Lithium Ion Batteries", Materials Research Society Symposium Proceedings, Vol. 706, 2002, pg. 10.5.1-10.5.7) and Peng et al (Nanoletters, 1, pages 625-629 (2001)).

However, Zhou et al as modified by Chen et al does not expressly teach an anode comprising lithiated single-walled nanotubes. The Raffaele reference discloses highly purified single-walled carbon nanotubes that are used as an anode material for lithium ion batteries (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include an anode that comprises single-walled carbon nanotubes in order to utilize an anode material that has high charge/discharge capacities.

However, Zhou et al as modified by Chen et al and Raffaele et al does not expressly teach a cathode comprising fluorinated single-walled nanotubes. The Peng reference discloses fluorinated single-walled nanotubes that are used as cathode materials in a lithium cell (See Abstract). The Ogura reference discloses chemical treatments of carbon nanotubes that are used for electrodes in a lithium battery that include oxidation with ozone (See paragraph [0046]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen/Raffaele battery to include a

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cathode comprising fluorinated single-walled nanotubes in order to increase the cell potential and improve the overall cell performance.

15. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 above, and further in view of Chen et al (US 2003/0077515).

However, Zhou et al as modified by Chen et al does not expressly teach an anode comprising a conducting polymer doped single walled nanotubes. The Chen '515 reference discloses an electronically conductive polymer/carbon nanotube composites that are used in energy storage devices such as secondary batteries (See paragraph [0001]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include an anode comprising a conducting polymer doped single walled nanotubes in order to provide a faster ionic charge transfer that is beneficial to increasing the power density of the battery.

16. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou et al (US 6422450) in view of Chen et al (US 7060390) as applied to claim 1 above, and further in view of Yang et al (Electrochemical and Solid State Letters, 6(8), pp. A154-A156 (August 2003)).

However, Zhou et al as modified by Chen et al does not expressly teach an anode comprising a lithium composite that is LiSiC. The Yang reference discloses a

Si/C composite as a lithium storage material for anodes for lithium ion cells (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Zhou/Chen battery to include anode comprising a lithium composite that is LiSiC in order to improve the capacity for lithium insertion by incorporating silicon.

Response to Arguments

17. Applicant's arguments with respect to claims 1-17 and 19-23 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571) 272-0717. The examiner can normally be reached on M-F, 7:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC


JONATHAN CREPEAU
PRIMARY EXAMINER